PDEIS-4: Comparison of landscape management alternatives for Lake Whatcom, with specific reference to carbon sequestration, forest product certification, and recreation values

By Bruce Glass, June 26, 2002

Results of the financial analyses of the various alternatives for management of trust lands in the Lake Whatcom landscape are displayed in Table PDEIS4-1. These results include only timber revenues captured by the department, and are based on an analysis that assumed the services of the land were obtained for no cost. Therefore the results presented in Table PDEIS4-1 should be interpreted as a financial analysis rather than either an economic or benefit-cost analysis.

Table PDEIS4-1: Results of a financial analysis of five timber production management alternatives for Lake Whatcom landscape region

Annual real discount rate	Alternative	Net present value of timber production ($000)	Difference in net present value relative to Alternative 1 ($000)	Annualized difference in net present value relative to Alternative 1 ($000/year for 200 years)
4%	1	38,975	0	0
	2	25,440	-13,535	-542
	3	5,319	-33,656	-1,347
	4	4,845	-34,130	-1,366
	5	0	-38,975	-1,560
6%	1	27,382	0	0
	2	17,682	-9,701	-582
	3	3,986	-23,397	-1,404
	4	3,674	-23,708	-1,423
	5	0	-27,382	-1,643
8%	1	21,199	0	0
	2	13,601	-7,598	-608
	3	3,226	-17,972	-1,438
	4	2,997	-18,202	-1,456
	5	0	-21,199	-1,696
10%	1	17,286	0	0
	2	11,076	-6,210	-621
	3	2,708	-14,578	-1,458
	4	2,528	-14,757	-1,476
	5	0	-17,286	-1,729

Note: Values are rounded

The reference alternative used in this portion of the Preliminary Draft Environmental Impact Statement (PDEIS) is Alternative 1. For a detailed description of management and other assumptions defining each alternative, refer to Section 3.2.

Financial data were only available for the first four alternatives (1 through 4) for this PDEIS. No land management modeling was undertaken for the fifth alternative, so for the purposes of this comparison of alternative, it was assumed that net harvest revenues were zero under alternative 5 and further, that no management costs unrelated to timber harvest were incurred under the fifth alternative. In effect, the net present value (NPV) for alternative 5 was assumed to be zero, an assumption that tends to overstate the actual NPV for alternative 5 since some, rather than no, active management is actually proposed under this alternative.

Some further comments regarding alternative 5 are also necessary here. Since no land management modeling was undertaken for alternative 5, no estimates of growing stock volume were available from which to derive estimates of sequestered carbon. Therefore it was not possible to estimate a breakeven value for carbon sequestered under this alternative. Also, since no timber harvest was assumed to occur under this alternative, it is not possible to produce certified wood products under this alternative either.

Note that while benefits and costs not accruing to land management are deliberately and specifically excluded from the results presented in Table PDEIS4-1, this is not to imply such benefits and costs do not exist. Indeed, these non-included benefits and costs can sometimes be very significant in their magnitude.

Marked differences between landscape management alternatives are apparent in Table PDEIS4-1. From a strictly financial perspective, selection of a management alternative with a lower financial return than the alternative with the highest return ought to imply that the difference in return might at least be partially justified by offsetting (net) returns the department could capture from other potential revenue sources. Some potential sources capable of producing such offsetting capturable revenue streams were identified as part of the scoping and consultation process, and include: (1) Carbon sequestration; (2) Certification of forest management practices; and (3) Recreation.

Estimates of capturable net returns from carbon sequestration, certification of forest management practices, and recreation are highly uncertain. A breakeven analysis approach was adopted in addressing the analytical challenge posed by this uncertainty. Policy decision-makers can thus use the comparative breakeven information to make findings as to the degree to which differences in financial returns from adopting particular courses of timber management are likely to be offset by potential returns from these other sources.

Carbon sequestration

Potential returns from carbon sequestration depend upon at least two factors. The first factor concerns whether sequestered carbon would actually be admissible for credit under a carbon credit trading scheme. For instance, the Kyoto Accord (which the USA has not ratified)

stipulates that carbon sequestered in the course of doing "business as usual" is not admissible for credit (IPCC, 2000). On the other hand, carbon sequestered as a result of management intervention deliberately undertaken in order to enhance carbon sequestration could be admissible for carbon credit. For the purposes of this PDEIS, carbon sequestered as a result of potential changes in management practices applied to the Lake Whatcom landscape is assumed to be eligible for credit recognition, regardless of whether the potential changes in management practice were proposed with a carbon sequestration objective in mind.

The value of sequestered carbon is the second factor affecting potential returns from carbon accounting. At present, the market for sequestered carbon is poorly developed, and so thinly traded that it is difficult to establish with confidence a market price per unit of carbon sequestered. The breakeven analysis approach adopted here addresses this concern indirectly, by indicating what would need to be obtained per unit of carbon sequestered in land set aside from timber production within the Lake Whatcom landscape.

In brief, the method for estimating the amount of sequestered carbon for each landscape alternative is as follows. One output of the land management analysis of the Lake Whatcom landscape is estimated forest growing stock volume (in merchantable volume terms) at certain times during the 200-year planning period. These estimates were averaged to obtain an average growing stock volume for the 200-year planning period. The differences between average growing stock volumes for each alternative were then converted into estimates of total tree (i.e., all tree components, and not just the merchantable stem) carbon using a conversion factor of 4,400 pounds of carbon per (merchantable) mbf (Perez-Garcia and Edelson, 2001. The resulting estimates of total tree carbon were then converted to total site carbon, assuming total tree carbon constituted some 25% of total site carbon), i.e., column D × 4,400 / 2000 / 0.25 = column E.

By way of a precautionary note, the approach used in this analysis is not a full-fledged economic valuation of the likely carbon sequestered under each management alternative. For example, in focusing on changes in the residual growing stock the analysis ignores the fate of carbon sequestered in harvested trees. The analysis also overlooks the impact of leakage, i.e., whether, in response to diminished tree harvesting in the Lake Whatcom landscape, increased compensatory harvesting occurs in other landscapes and ownerships.

The results of this analysis are shown in Table PDEIS4-2 below. The results indicate that the carbon credit breakeven value ranges from $14/ton to $34/ton, decreasing as the discount rate increases (i.e., column F = column C / column F).

Interpreting the breakeven values for sequestered carbon is challenging since the present poorly developed and thinly traded state of the carbon market at present means reported prices are not necessarily reflective of what might be expected under competitive market conditions (i.e., when fully informed and numerous buyers and sellers voluntarily agree on terms of exchange). In the absence of a reliable market price for sequestered carbon, an alternative approach to evaluating the financial viability of carbon sequestration relative to timber production is to estimate the breakeven value at which net carbon returns (on the land removed from timber production) would equal net returns to timber production, i.e., the carbon value at which a tree grower would

choose to leave trees standing for carbon sequestration returns rather than harvesting them for timber income. This comparison is captured in Figure PDEIS4-1 below.

Table PDEIS4-2: Derivation of breakeven values for additional carbon sequestered in three management alternatives for the Lake Whatcom landscape compared with a reference alternative (Alternative 1)

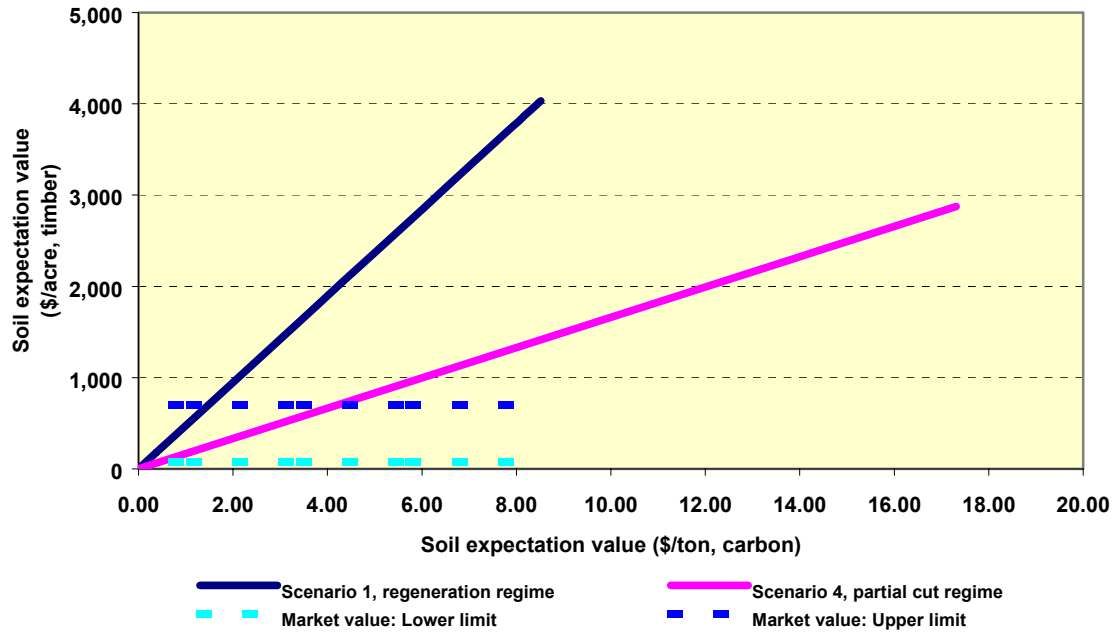
A	B	C	D	E	F
Annual real discount rate	**Alternative compared with reference alternative**	**Difference in net present value relative to reference alternative ($000)**	**Difference in average growing stock volume relative to reference alternative (mmbf)**	**Difference in average total site carbon relative to reference alternative (000 tons)**	**PV of breakeven value of carbon credit ($/ton)**
4%	2	-13,535	45	398	34
	3	-33,656	114	1,004	34
	4	-34,130	117	1,034	33
6%	2	-9,701	45	398	24
	3	-23,397	114	1,004	23
	4	-23,708	117	1,034	23
8%	2	-7,598	45	398	19
	3	-17,972	114	1,004	18
	4	-18,202	117	1,034	18
10%	2	-6,210	45	398	16
	3	-14,578	114	1,004	15
	4	-14,757	117	1,034	14

Note: Values are rounded

The data presented in Figure PDEIS4-1 compare soil expectation value (SEV, i.e., the value one could afford to pay for bare land to be managed in a certain way, in this case for either timber production or for carbon sequestration) with the equivalent carbon values, for two silvicultural regimes utilized in Alternatives 1 and 4, at a real discount rate of 4% per year. These alternatives and the 4% discount rate are the alternatives that will most likely span the range within which the highest returns to land management will lie. The dashed lines in Figure PDEIS4-1 are approximate lower and upper limits of market values for timberland, obtained from transactions and appraisals in the Puget Sound area observed at the start of 1998. These values ranged from $75/acre to some $700/acre, depending upon site productivity and other factors.[1]

[1] These land values are not likely to have appreciated greatly since then, given subsequent trends in timber prices.

Figure PDEIS4-1: Breakeven soil expectation values for total sequestered site carbon compared with timberland market values, for selected regimes and scenarios applied to bare land in the Lake Whatcom landscape under a 4% real discount rate



Note: Regime specifications are inferred from management simulations for Lake Whatcom landscape

The intersections of the solid lines with the dashed lines allow one to infer a maximum breakeven value for carbon sequestered using management regimes similar to those simulated for the Lake Whatcom landscape, i.e., this value is likely to be less than $6/ton for the $75-700/acre range of timberland values. Even if SEVs were as high as $2,000/acre, the breakeven carbon value at which a timberland owner would be indifferent to harvesting a stand for timber as opposed to retaining it for sequestration purposes would still be less than about $12/ton, as opposed to the equivalent $33-34/ton estimates presented in Table PDEIS4-2. These values indicate that, at current prices and yields, additional carbon sequestered in alternatives 2, 3, and 4 is likely to be very much more expensive than the alternative approach of deliberately growing a tree crop for carbon sequestration.

Certification of forest management practices

Several reasons have been propounded for certification of forest management practices, including acquiring and retaining market access, increasing market share, and capturing premium prices (generally in the lumber market). This section critically evaluates the idea that price premia for certified lumber constitute a potential revenue source that could offset cost differences between land management alternatives. An underlying assumption of the analysis presented here is that the Lake Whatcom landscape can in fact achieve certified status, and independently of other landscapes managed by the department, if necessary.

Much of the evidence advanced regarding certified lumber products capturing price premia is arguable, being based on anecdote and/or expression of willingness-to-pay rather than observed

market behavior. From the perspective of a breakeven analysis, the key to understanding how likely certification will yield positive net returns to land management involves appreciating that returns to land management are, in effect, a residual value. In terms of residual value, any price premium recovered from certified lumber in the lumber market would have to be passed back to the grower in the stumpage market in order to justify implementing changes in land management practices. In practice, what this means is that the estimated breakeven premia in the stumpage market would need to be exceeded by actual premia in the lumber market by amounts that reflect, among other factors, relative differences in supply and demand responsiveness (elasticities) in the stumpage and lumber markets, the degree of vertical integration in the production–marketing chain (and especially between tree grower and processor), and the relative size of firms in the supplier and processor sectors.

The assumption that downstream entities in the production-marketing chain would actually pass any price premia back to prior stages of the chain, eventually reaching the grower, is critical. A lumber seller would not necessarily be willing—nor be forced through competition--to pass on any premia for certified lumber that might actually exist in the lumber market. In this eventuality, it is highly likely that the breakeven premia estimated in this analysis will actually understate the actual lumber price premium that would have to be realized in the lumber market in order for a tree grower to break even in the stumpage market.

Estimates of breakeven price premia were calculated as follows. First, estimates were made of average annual harvest volume differences between Alternatives 2 through 4 relative to the reference alternative (Alternative 1). These harvest differences were then converted to lumber volumes using a (generous) overrun factor of 2 (based on a regional average for sawmills in the Puget Sound vicinity, including Whatcom, Skagit, Snohomish, King, and Pierce Counties; Larsen, in prep.). The breakeven premia were then estimated by dividing the differences in present values between the reference and the alternate alternatives by the estimated differences in lumber outturn. Results are presented in Table PDEIS4-3 below.

Assuming the management Alternatives 2 through 4 also include costs associated with certification of forest management practices[2], the breakeven analysis indicates that the forest grower would need to recover average stumpage price premia of more than about $99/mbf in present value terms, depending upon alternative and discount rate (column F, Table PDEIS4-3). To put the matter another way, certified lumber produced from sawlogs originating from DNR-managed land in the Lake Whatcom landscape area would have to return a lumber price premium of at least $99/mbf (= -542,000 divided by 2,730 divided by 2), assuming this price premium was passed back to the grower in its entirety. For comparison purposes, the market price of green Douglas fir 2 × 4 standard and better grade lumber at a Portland (OR) price point was about $300/mbf for calendar year 2001, while the average stumpage DNR received for sales sold in the same period was some $289/mbf.

[2] Since the alternatives do not actually include these costs, the differences in returns potentially understate the magnitude of the actual differences in returns between the reference and other alternatives.

Table PDEIS4-3: Estimation of implied price premium for certified lumber required in the stumpage market level in order for the tree grower to breakeven on the net revenue differences between three proposed landscape management alternatives for the Lake Whatcom landscape, and the reference alternative (Alternative 1)

A	B	C	D	E=D*2	F=C×1000/E
Annual real discount rate	**Alternative compared with reference alternative**	**Annualized difference in net present value relative to reference alternative ($000/year)**	**Average annual harvest (mbf/year)**	**Average annual lumber outturn based on average annual harvest (mbf/year)**	**Implied price premium for certified lumber the tree owner needs to receive to break even ($/mbf)**
4%	2	-542	2,730	5,460	99
	3	-1,347	492	984	1,369
	4	-1,366	428	856	1,595
6%	2	-582	2,730	5,460	107
	3	-1,404	492	984	1,427
	4	-1,423	428	856	1,662
8%	2	-608	2,730	5,460	111
	3	-1,438	492	984	1,461
	4	-1,456	428	856	1,701
10%	2	-621	2,730	5,460	114
	3	-1,458	492	984	1,481
	4	-1,476	428	856	1,724

Note: Values are rounded

This analysis should not necessarily be interpreted as a case for not undertaking certification. As noted at the outset, there are potentially important reasons other than price premia that might justify certification of forest management practices. Certification increasingly looks like becoming part of the overhead cost of doing business in the wood products industry, particularly as forest products companies develop and implement environmental strategies for marketing their wood products. However, in the absence of vertical integration or competition sufficient to allow efficient and effective passing of price signals back through successive levels of the production-marketing chain to the grower, it appears doubtful that forest growers will capture sufficient returns from price premia for certified wood products to justify financially the selection of any of Alternatives 2 through 4.

Recreation

Lake Whatcom and the surrounding landscape provide an important recreation resource for people in Bellingham, Whatcom County, and beyond. Recreation in the Lake Whatcom landscape mainly centers on dispersed rather than concentrated recreation activities, although some of the dispersed recreation activities may be concentrated at certain specific locations from time to time (e.g., boat launches, etc.).

Dispersed recreation activities pose a significant management challenge when it comes to establishing and implementing fee-based recreational programs for a variety of reasons, including: (1) Revenues from fee-based programs may not necessarily cover compliance and other program management costs; (2) Collecting recreation fees is likely to render the department liable for injuries to recreational users of state-owned land, a liability presently limited by RCW 4.24.210; and (3) Resistance to fee-based programs, especially in situations when a fee is imposed where no prior fee existed. Alternatives to fee-based recreation use programs were also considered in compiling this analysis. For example, an access permit essentially involves collecting a fee for parking at trailheads and the like, but analysis of this alternative was not pursued since candidate sites for such a program do not presently exist on DNR-managed land (although their development might, some time in the future, be feasible under Alternatives 1 through 5).

In recognition of the financial, practical, and other challenges facing fee-based recreational programs, a different approach to capturing revenue from recreational activities is adopted here. The analytical approach remains the same (i.e., breakeven analysis), but rather than attempting to estimate revenues and costs associated with fee-based recreational programs, potential recreation revenues are estimated assuming state trust land with water frontage is leased to a private sector entity for resort purposes. The breakeven analysis assumes revenue from such a development would be a certain proportion of unimproved land value. Land suitable for such a hypothetical resort is assumed available on the shores of Lake Whatcom. In addition, this approach assumes such a resort would be—or could be made—compatible with existing zoning and other land use planning commitments.

At the outset, it is readily acknowledged that this hypothetical resort-based approach to recreational development may not be the most suitable, the most appealing, or even a successful approach to obtaining revenues from recreational activities that could offset differences in timber harvest revenues between the reference and other alternatives. Rather, the intent in taking this approach is to develop, for comparison purposes, a highly optimistic estimate of potentially capturable recreation revenues for the Lake Whatcom landscape. This analytical approach does not advocate that such a hypothetical resort-based proposal is or could be practical, feasible, or acceptable.

The hypothetical resort was conceived as a ‘destination resort’ notion, i.e., having sufficient quality and diversity of amenity in and of itself to attract clientele, perhaps associated with ‘soft adventure’ options combining challenging daily outdoor recreation activities with overnight comforts. The leased property was therefore assumed to be sited on the shores of Lake Whatcom, and sufficiently extensive to accommodate an 18 hole golf course. A generous

estimate of 150 acres was used in the analysis, consisting of 50 acres of waterfront property, backed by a further 100 acres of non-waterfront property.

Waterfront property values for the hypothesized resort were estimated using property tax assessment data obtained from the Whatcom County Assessor Office: specifically, unimproved property values in the vicinities of North Shore and Blue Canyon Roads. Examination of these data indicated that parcels of the size required for the potential resort would be unlikely to be valued higher than $20,000/acre. Per acre property values for the non-waterfront portion were assumed to be half of those of the waterfront portion.

Assuming a generous lease rate of 10% of unimproved land value as the basis for estimating lease revenues from the hypothesized resort, the annual lease rental revenues would amount to an optimistic $200,000 per year. This amount falls well short of what would be needed in the way of an annual revenue flow to compensate for the annualized difference in net present value between the reference alternative and Alternatives 2 through 5 (column E, Table PDEIS4-4). However, if realizable (and realized), this return would be very attractive compared with potential timber revenues from 150 acres of waterfront timberland on the shores of Lake Whatcom.

The above estimate of revenues includes only those revenues accruing to the upland component of the hypothesized resort, since the Lake Whatcom landscape plan and process is primarily concerned with upland management issues. Lease revenues might also be anticipated from leasing aquatic lands to the hypothesized resort, perhaps for a resort marina. Because these lease revenues would be derived from aquatic lands, they cannot be counted as part of the upland revenue stream offsetting the difference between the reference alternative and Alternatives 2 through 4. These revenues are likely to be relatively small anyway: using the currently mandated formula, they could amount to some $367/acre/year, or about $3,700/year for a 10 acre marina. For comparison purposes, in (year ending June) 2001 total annual lease revenues for water-dependent use[3] leases in Whatcom County was some $82,000, of which about $14,000 was obtained from marinas on Lake Whatcom.

[3] A 'water dependent use' has a specific legal definition. Activities are legally defined as water dependent if they cannot logically exist in any location except on the water. For further details refer to RCW 79.90.465.

Table PDEIS4-4: Comparison of estimated ground rent for an hypothetical resort development on Lake Whatcom waterfront, with the difference in estimated annual revenues for landscape management alternatives 2 through 5 with the reference alternative (Alternative 1)

A	B	C	D	E=C+D
Annual real discount rate	**Alternative compared with reference alternative**	**Annualized difference in net present value relative to reference alternative ($000/year)**	**Annual ground rent from hypothetical destination resort development ($000/year)**	**Difference ($000/year)**
4%	2	-542	200	-342
	3	-1,347	200	-1,147
	4	-1,366	200	-1,166
	5	-1,560	200	-1,360
6%	2	-582	200	-382
	3	-1,404	200	-1,204
	4	-1,423	200	-1,223
	5	-1,643	200	-1,443
8%	2	-608	200	-408
	3	-1,438	200	-1,238
	4	-1,456	200	-1,256
	5	-1,696	200	-1,496
10%	2	-621	200	-421
	3	-1,458	200	-1,258
	4	-1,476	200	-1,276
	5	-1,729	200	-1,529

A note on indirect impacts

As noted above, the above analysis is a financial analysis, and not an economic or benefit-cost analysis. Furthermore, the financial analysis only examines direct financial impacts on returns to land management associated with the proposed land management alternatives. However, there are other indirect impacts also associated with the choice of land management alternative that, while perhaps not significant in the context of this financial analysis, could very well be significant in a broader economic or benefit-cost analysis context. These indirect impacts include so-called multiplier effects.

Such indirect impacts and multiplier effects have not been examined in this analysis. For example, it certainly seems reasonable to anticipate adverse employment impacts associated with the reduced timber harvests anticipated under Alternatives 2 through 5. However, quantifying the net effect of these impacts becomes highly speculative when one considers the degree to which those adverse impacts might be offset by whatever employment gains might occur

elsewhere in the economy as a consequence of choosing either of Alternatives 2 through 5 over the reference alternative. To quantify adverse impacts without similarly quantifying offsetting positive impacts poses a distinct possibility of analytical bias.

Conclusions

- At current prices and yields, the breakeven values of additional carbon sequestered under the proposed Lake Whatcom landscape management alternatives are likely to be very high relative to the alternative of deliberately planting bare land for carbon sequestration purposes. This prospect means returns for carbon sequestered in the Lake Whatcom landscape (if any) would probably not produce revenues sufficient to justify choice of either of alternatives 2, 3, or 4 over the reference alternative (Alternative 1). Insufficient data were available to analyze returns to carbon sequestration for Alternative 5 relative to the reference alternative.

- Whether or not certified lumber products attract a premium price in the market, any price premium associated with certified softwood lumber would have to return between at least $100/mbf and $147/mbf to the forest grower, in order to financially justify choice of landscape management Alternatives 2 through 4 over the reference alternative (Alternative 1). It appears highly unlikely that premia of these magnitudes are likely to be realized by the forest grower, especially in the context of current lumber and stumpage prices. Offsetting revenues from production of certified wood products is not logically possible under Alternative 5.

- Estimated lease revenues from a hypothesized destination resort development on the shores of Lake Whatcom are unlikely to completely offset timber harvest revenues forgone under landscape management Alternatives 2 through 5.

- It appears highly unlikely that combined revenues from carbon sequestration, certified lumber production, and leasing of trust land for recreation activities could financially justify the choice of either of landscape management alternatives 2 through 4 over the reference alternative (Alternative 1).

Glossary

Carbon credit: Measured amount of carbon captured by anthropogenic activities, recorded against a carbon ledger (as opposed to a carbon debit, i.e., a measured amount of carbon released by anthropogenic activities, also recorded against a carbon ledger)

Carbon sequestration: Transformation of carbon into forms temporarily or permanently incapable of contributing to atmospheric temperature change

Certification: Continual assessment process in which forest management practices (and wood processing activities) are assessed against a set of explicit criteria developed to ensure externally recognized practice standards are achieved and maintained

Discount rate: Substitution of current consumption for future consumption, reflecting a measure of an underlying willingness to defer consumption to a future time, i.e., the price or cost of time. A 10% annual discount rate indicates that $1.00 now will be worth $1.10 in one year's time (or *vice versa*) or, alternatively, that $1.00 in one year's time is worth $0.91 now (or *vice versa*).

Nominal: Not adjusted for the effects of changes in prices over time, i.e., embodies an inflationary premium.

Present value: Conversion of costs and returns incurred or obtained at future times to equivalent values at the current time, by means of a discount rate.

Real: Adjusted for the effects of inflation, i.e., adjustment of values for changes in prices over time.

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